

Using Satellites to Help Conserve Aggregate Resources in California

Background of the Project

Aggregate (sand and gravel, crushed stone) is currently the most important mineral resource consumed in California. It is the foundation of the modern construction industry. Land use that precludes mining of this resource is a problem in many urbanizing areas of the state. The cost of aggregate rises significantly when it has to be mined and transported from increasingly greater distances from its point of use. In California, the cost to consumers for each ton of concrete-grade aggregate can range from \$7 to \$20 at the mine, plus an additional \$0.10 to \$0.15 for every mile it is transported from the mine to its site of use.

The Department of Conservation's California Geological Survey (www.consrv.ca.gov/cgs) is mandated by state law to map aggregate resources and forecast demand for them throughout California, particularly in urbanizing areas. Previously, the CGS has used field observations and aerial photographs to accomplish these tasks. Field work is expensive, however, and available photographs are often inconsis-



tent in coverage or outdated. In late 2001, the CGS was awarded a 2-year research grant by the National Aeronautics and Space Administration (NASA) for a project to use satellite images in its program of mapping aggregate resources in California. The grant was awarded under NASA's Broad

Agency Announcement Program (www.esad.ssc.nasa.gov/baa), which is designed to establish use of remote-sensing products (e.g., satellite images) by state, regional, local, and tribal government agencies for solving problems related to land-use, urban growth, natural resources, and natural hazards.

Scope of the Project

The project is being conducted in two urbanizing areas of southern California, Palm Springs and Bakersfield. The aggregate resources of both areas were first mapped in the late 1980s by the CGS. We are now re-mapping the areas to determine how much of the resources have been either consumed or lost to alternative land use that precludes mining. This determination will be used to revise both our estimates of available resources and our forecasts of production and consumption.



Through the NASA grant, the CGS is obtaining high-resolution satellite images of both areas with the expectation of reducing field work and replacing aerial photographs for re-mapping of the local aggregate resources. The satellite images will be used within a geographic information system (GIS) to map how much urbanization and other incompatible land use have infringed upon these aggregate resources. In turn, this mapping will help us calculate, in tonnage and dollars, how much aggregate has been lost to this alternative land use.



Participants

The project involves geologists and GIS specialists from the CGS in partnership with technical advisors from NASA. It will also lead to technical staff of the CGS routinely applying satellite data in future studies of aggregate and other mineral resources.

Benefits

There are benefits from this project at two levels. First, at the operational level, use of satellite images by CGS staff is expected to save our agency (and thus taxpayers) money in operating expenses and to improve the quality and content of our maps and calculations of aggregate resources. This benefit will expand at the second, or community level, where our maps and calculations are used by government agencies to make land-use decisions. The main goal of our products is to protect aggregate resources from being lost to incompatible land use. By using our calculations of how much aggregate has been lost and our forecasts of the expected future demand for aggregate, local government can take steps to protect and conserve remaining resources. Each citizen benefits when local aggregate resources are protected for future use because transportation is less, which reduces shipping cost, truck traffic, noise, fuel consumption, and air pollution.

We envision the expansion of this application of satellite images to aggregate-mapping operations by other states as well as to conservation of mineral resources other than aggregate.

For additional information please contact:

Chris Higgins
Principal Investigator
chiggins@consrv.ca.gov
(916) 322-9997

